The Effelsberg–Bonn HI Survey (EBHIS)

B. Winkel[1,2], J. Kerp[2], P. Kalberla[2], and R. Keller[1]

[1] Max-Planck-Institut für Radioastronomie, International Max Planck Research School (IMPRS) for Radio and Infrared Astronomy at the Universities of Bonn and Cologne, Auf dem Hügel 69, 53121 Bonn, Germany
bwinkel@astro.uni-bonn.de
[2] Argelander-Institut für Astronomie, Auf dem Hügel 71, 53121 Bonn, Germany

The new L-band 7-feed-array at the 100-m telescope in Effelsberg will be used to perform an unbiased fully sampled HI survey of the entire northern hemisphere observing the galactic and extragalactic sky using simultaneously two different backends. The integration time per position will be 10 min towards the SDSS area and 2 min for the remaining sky, thereby achieving a sensitivity competitive with the Arecibo ALFALFA and GALFA surveys but covering a much larger area of the sky.

Both backends are FPGA-based digital fast fourier transform (DFFT) spectrometers, offering a superior dynamic range and temporal resolution. The latter is crucial for a sophisticated RFI mitigation scheme (Winkel et al. 2007) but produces huge amounts of data over the projected five years of observing. Consequently, we put considerable effort into efficient data reduction. Table 1 compares the survey parameters with several recent HI surveys.

The data processing is organized making use of individual data reduction modules. Each module calculates correction factors/spectra that are stored in a database. A special merger module is used to apply all corrections to the data before the gridder produces a final data cube. The advantage of this approach is the flexibility to modify individual modules without having to recompute all corrections.

Most of the reduction modules are ready-for-use. Winkel et al. (2007) describe a very sensitive RFI detection scheme, utilizing the high temporal resolution spectra from the DFFT spectrometers. The stray-radiation correction is performed using the method of Kalberla et al. (2005). Their approach enables stray radiation correction even within the regime of the high-velocity clouds. We also implemented and improved (see Winkel & Kerp 2007) the recently proposed least-squares frequency switching (LSFS) method of Heiles (2007). Using more than two different intermediate frequency settings, one is able to calculate the baseline even for faintest HI emission with unprecedented quality. Finally, we developed a graphical user interface (GUI) optimized for the search and parametrization of galaxies in the HI data cubes. We imple-

Table 1. Parameters of several recent HI surveys in compared to EBHIS.

Survey	Telescope	Type	Status	Area (sq.deg.)	Beam size (arcmin)	$z_{\max}$	Δv (km/s)
LAB	Dwing/Arg	g	Completed	41 300	36		1.3
HIPASS	Parkes	e	Completed	29 300	14.1	0.05	18
GASS		g	Ongoing	20 600			0.8
ALFALFA	Arecibo	e	Ongoing	7 100	3.4	0.06	11
GALFA		g	Ongoing				0.7
EBHISe	Effelsberg	e	Planned	20 600 (8 500*)	9	0.07	7
EBHISg		g	Planned				1

Survey	RMS noise (mJy/Beam)	$N_{\rm HI}$ limit (10^{18} cm^{-2})	Mass limit (10^7 M$_\odot$)	Velocities (km/s)	Integr. time per beam (s)
LAB	620	3.3		− 450 . . . 400	
HIPASS	13		8.7	−1 280 . . . 12 700	450
GASS	95	2.6		− 400 . . . 450	90
ALFALFA	1.6		0.8	−2 000 . . . 18 000	28
GALFA	13.2	3.2		− 700 . . . 700	18
EBHISe	4.5 (2*)		1.9 (0.8*)	−2 000 . . . 18 000	120(600*)
EBHISg	12 (5.5*)	0.9 (0.4*)		− 500 . . . 500	

*Towards the SDSS area EBHIS has higher sensitivity.

mented a very promising finder algorithm based on the Gamma test (Boyce 2003). The GUI is designed to allow a fast working flow and is able to compute statistical errors using Markov chain Monte Carlo methods.

EBHIS will be extremely valuable for a broad range of research topics: study of the low-mass end of the HI mass function (HIMF) in the local volume, environmental and evolutionary effects (as seen in the HIMF), the search for galaxies near low-redshift Lyman-alpha absorbers, and analysis of multiphase and extraplanar gas, HI shells, and ultra-compact high-velocity-clouds (Brüns & Westmeier 2004).

References

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